 Key

larger charges & smaller radii → strongest attraction (lattice E) so requires more E to break apart.

Practice Exam #3

1) Which of the following ionic compounds has the greatest melting point?

a. LiF $Li^+ F^-$ b. BeF_2 $Be^{2+} F^-$ (c.) BeO $Be^{2+} O^{2-}$ d. Li_2O $Li^+ O^{2-}$

2) The wavelength of light emitted from a traffic light having a frequency of 5.75 x 10^{14} Hz is _____.

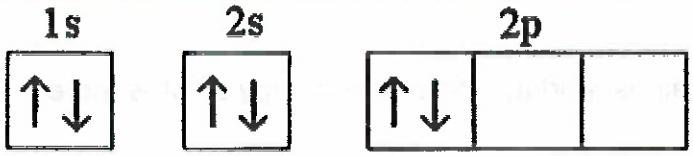
(a.) 522 nm b. 641 nm c. 674 nm d. 702 nm

$c = \lambda\nu$ $\lambda = \frac{c}{\nu}$ $522\,nm = 5.22\times10^{-7}\,m = \lambda = \frac{(2.998\times10^{8}\,m/s)}{(5.75\times10^{14}\,s^{-1})}$

3) Which electron configuration represents a violation of the Pauli exclusion principle?

↳ No two e⊖s can have the same set of four quantum #s ∴ 0 e⊖s in the same orbital must have opposite spins (m_s) & ② e⊖s in degenerate orbitals will have parallel spins

a.

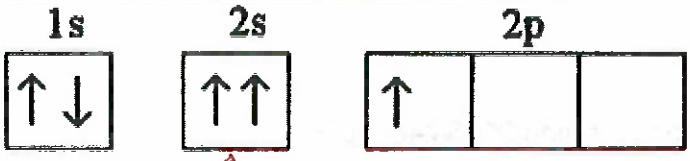


← Violates Hund's Rule

b.

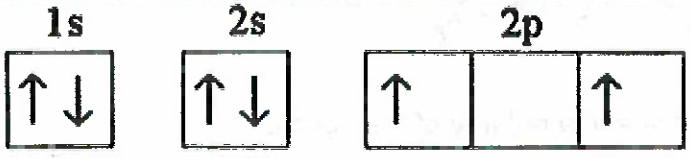
← doesn't violate any rule

c.



↑ violates Pauli Exclusion Principle

d.

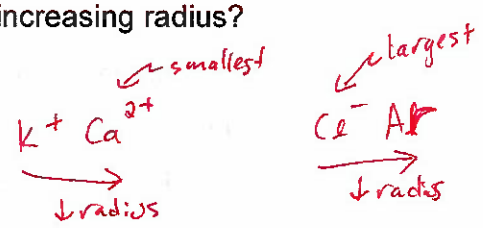


← doesn't violate any rule

Key

4) Which isoelectronic series is correctly arranged in order of increasing radius?

a. ~~$K^+ < Ca^{2+} < Ar < Cl^-$~~
b. ~~$Cl^- < Ar < K^+ < Ca^{2+}$~~
c. $Ca^{2+} < Ar < K^+ < Cl^-$
d. $Ca^{2+} < K^+ < Ar < Cl^-$



5) Which of the following statements is true about the electron affinity of Cl and the ionization energy of Cl^-?

very high b/c at a noble gas config. already ∴ neg. E.A. b/c will get to a noble gas configuration

a. They are equivalent values.

b. They are equal in magnitude, but opposite in sign.

c. They are both positive values, and the ionization energy of Cl^- is more positive.

d. They are both negative values, and the ionization energy of Cl^- is more negative.

$Cl^- \rightarrow Cl + e^-$ ← opposite rxns ∴ equal in magnitude, opposite in sign → $Cl + e^- \rightarrow Cl^-$

6) Which of the following represents an acceptable set of quantum numbers for an electron in an atom? (arranged as n, l, m_l, m_s)

integer 1→7 ↵ ↳ 0→n-1 $-l \rightarrow +l$ $+\frac{1}{2}$ or $-\frac{1}{2}$

a. 2, ~~2~~, -1, -½ b. 1, 0, 0, ½ c. 3, ~~3~~, ~~3~~, ½ d. 5, 4, ~~-5~~, ½

7) Which species has the electron configuration $[Kr]5s^24d^{10}5p^3$?

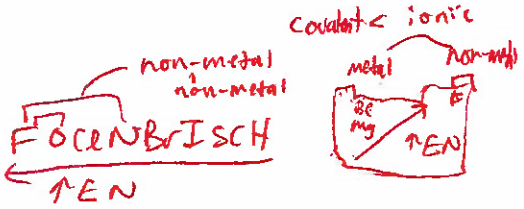
a. In^{3+} b. Sn c. Sb^- d. Te^+

$[Kr]\,4d^{10}$ $[Kr]\,5s^2 4d^{10} 5p^3$ $[Kr]\,5s^2 4d^{10} 5p^4$ $[Kr]\,5s^2 4d^{10} 5p^3$

8) Arrange the following in terms of *increasing* polarity of the bonds.

Be–F Mg–F N–F O–F

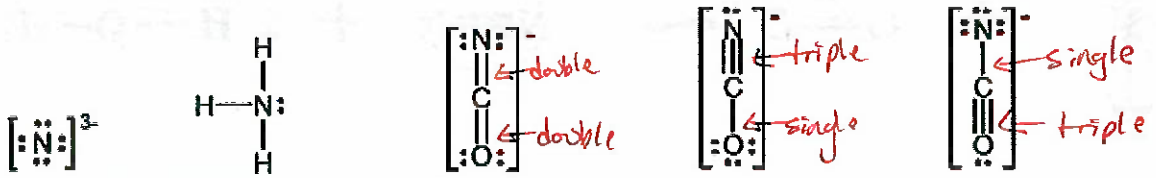
O–F < N–F < Be–F < Mg–F



Key

9) Consider the following, and select the letter that best corresponds to the statements below.

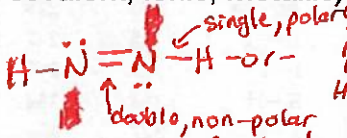
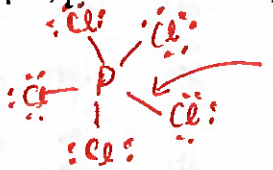
a. b. c. d. e.



i) Which nitrogen will have the *largest* radius? (a)
ii) Which molecule contains the *longest* bond between **C & N**? (e)
iii) Which molecule contains the *strongest* bond between **C & O**? (e.)
↳ shortest

10) For the molecules below,

i) Draw one plausible Lewis dot structure.
ii) What type of bond is between the atoms (single, double, triple, polar covalent, nonpolar covalent, ionic, metallic)?

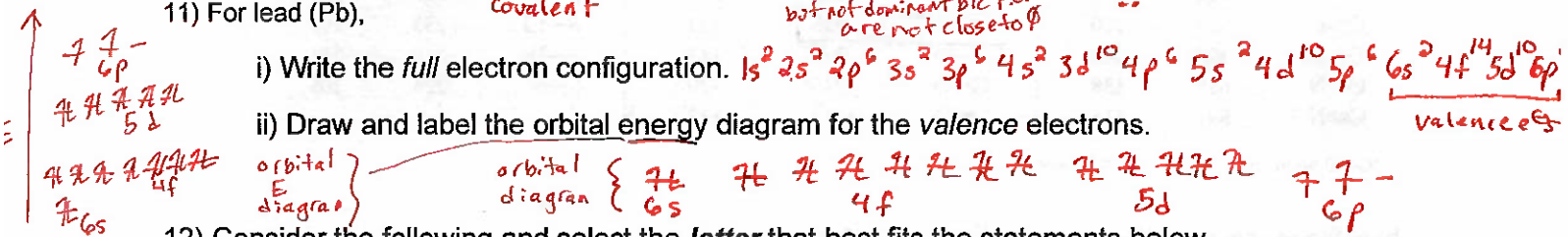
N_2H_2  **PCl_5** 

single, polar covalent
double, non-polar covalent
follows octet but not dominant b/c F.C. are not close to 0
single bond
polar covalent

11) For lead (Pb),

i) Write the *full* electron configuration. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^{10} 5p^6 6s^2 4f^{14} 5d^{10} 6p^2$ (valence e⁻s)

ii) Draw and label the orbital energy diagram for the *valence* electrons.



12) Consider the following and select the ***letter*** that best fits the statements below.

(***A***) $1s^2 2s^2 2p^6 3s^1$ (***B***) $1s^2 2s^2 2p^6 3s^2$ (***C***) $1s^2 2s^2 2p^6 3s^2 3p^1$ (***D***) $1s^2 2s^2 2p^6 3s^2 3p^5$

Na Mg Al Cl

(i) The electron configuration belonging to the atom with the ***highest second*** ionization energy is: A
↳ from Noble gas config. ↳ remove 2e⁻

(ii) The electron configuration that belongs to the atom with the ***lowest second*** ionization energy is B

(iii) The electron configuration of the atom with the ***most negative*** electron affinity is D
↳ E released when gain e⁻

Key

13) a) Estimate the ΔH_{rxn}. Show all work.

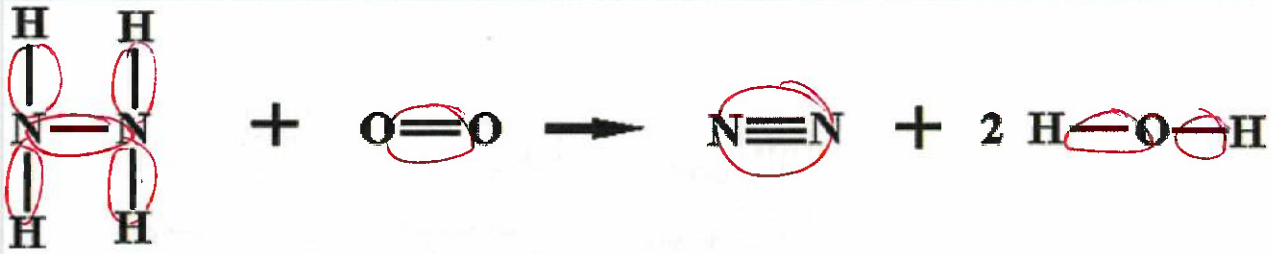


TABLE 8.6 Average Bond Dissociation Energies and Bond Lengths for Some Common Covalent Bonds

Bond	Energy (kJ/mol)	Length (pm)	Bond	Energy (kJ/mol)	Length (pm)	Bond	Energy (kJ/mol)	Length (pm)
H—H	432	75	N—H	391	101	F—F	154	142
H—F	565	92	N—F	272	136	F—Cl	253	165
H—Cl	427	127	N—Cl	200	175	F—Br	237	176
H—Br	363	141	N—Br	243	189	F—I	273	191
H—I	295	161	N—N	160	145	Cl—Cl	239	199
C—H	413	109	N=N	418	125	Cl—Br	218	214
C—F	485	135	N≡N	941	110	Cl—I	208	232
C—Cl	339	177	O—H	467	96	Br—Br	193	228
C—Br	276	194	O—F	190	142	Br—I	175	247
C—I	240	214	O—Cl	203	172	I—I	149	267
C—C	347	154	O—I	234	206	S—H	363	134
C=C	614	134	O—O	146	148	S—F	327	156
C≡C	839	120	O=O	495	121	S—Cl	253	207
C—N	305	143	C—O	358	143	S—Br	218	216
C=N	615	138	C=O	745*	120	S—S	226	205
C≡N	891	116	C≡O	1072	113			

*C=O bond energy in CO_2 is 799 kJ/mol.

b) Is the reaction exothermic or endothermic? (2 pts)

1 N-N 160 = 160
4 N-H 391 = 1564
1 O=O 495 = 495

1 N≡N 941 = 941
2 O-H 467 = 934 x 2 = 1868

$\Delta H_{rxn} = \Sigma \Delta H_{bonds\ broken} - \Sigma \Delta H_{bonds\ formed}$

$= (160_{kJ} + 1564_{kJ} + 495_{kJ}) - (941_{kJ} + 1868_{kJ})$

$= (2219\ kJ) - (2809_{kJ})$

$\Delta H_{rxn} = -590\ kJ$

exothermic